SEMESTER V

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. III Year (4YDC)
CE31006 ENVIRONMENTAL ENGINEERING

CREDITS:

HOURS PER WEEK			CREDITS			MAXIMUM MARKS				
						THEORY		PRACTICAL		TOTAL MARKS
T	P	Tu.	T	P	Tu.	CW	END SEM	SW	END SEM	
3	2	-	3	1	-	30	70	40	60	200

Pre-Requisite: Engineering Chemistry

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:

Course objective is to inculcate and aware about basic aspects and considerations of sources of water and wastewater, water and wastewater quality, its conveyance, types of pipes, valves and joints in pipe lines used in water supply scheme and design of water distribution network and sewerage system. This subject provides an aid for the students in the environmental engineering field to understand water supply scheme and sewer networks.

COURSE OUTCOMES:

Students will be able to

1. Determine types of sources, intake works and common impurities in water, population forecasting methods and examination of physicochemical and bacteriological quality of water.
2. Describe pipes used in water supply scheme-types of joints, valves, fittings etc. including corrosion in pipes.
3. Analyze water distribution network and aspects of leak detection.
4. Determine and analyze quality of wastewater/sewage and significance of various Parameter related to same.
5. Classify types of sewerage system and analyze hydraulic design of sewers.

Mapping of CO with PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	0	0	2	1	0	0	0	0	0
CO2	3	3	1	0	0	0	0	0	0	0	0	0
CO3	3	2	1	0	2	0	1	0	0	0	0	0
CO4	3	2	0	0	0	2	0	0	0	0	0	0
C05	3	2	1	0	0	0	0	0	0	0	0	0

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS: -

THEORY

Unit - 1

Quantity and Quality of Water: Introduction, quantity of water, population forecasting different methods, limitations, and field practice, water needs-different uses, factors influencing demands, fluctuation in demand (daily, hourly and seasonal), design period.

Quality of water-objective, types of impurities and their sources and effects, water borne diseases, standard of drinking water, examination of water (physical, chemical & bacteriological and sanitary significance as of important parameters, sources-ground and surface sources and their quality, impounding reservoir and its capacity, safe yield of wells. Intakes- types & working.

Unit – 2

Water Transmission: Materials and class of pipes-specification, merits & demerits of pipes cast iron, vertically cast and spun pipes, mild steel pipes, asbestos cement, R.C.C and prestressed pipes, bell and spigot joint, double flanged joints, special joints, rubber gaskets and roll-on joints, joint material poured joints, electrically involuted joints wrought iron pipes and fittings, service pipes, connections and size, material of pipes.

Corrosion in pipes - Galvanic, Biochemical, Biological, Stress Corrosion.

Unit - 3

Distribution System: Types of distribution systems, main considerations, design of distribution system, Hazen William's formula and its application, analysis of Hydraulic pressures and flow, equivalent pipe method for parallel and series pipes, location of mains, specials and fitting such as tees, bends reducers and valves locations, leak detection, its importance, extent of leakage methods of detection. Introduction to Water Audit and SCADA system.

Unit - 4

Quality of Waste Water: Characterization & composition physical, chemical, microbiological, primary parameters of pollution BOD, COD, total solids, volatile solids total organic carbon, nitrogen & its forms, pH, Chlorides, Colour, Toxic Substances, Micro Organisms etc.

Unit - 5

Design of Sewerage System: Types of systems, sanitary sewers, storm sewers, combined and partially combined sewers, quantity of sewerage, infiltration, design period, factors, self-cleansing velocity, maximum velocity depth/section of sewers, minimum size, slope, alignments. Manholes, Ventilating Shafts etc. Use of Manning's Formula, Partial Flow in Sewers, Design of Sewers from Flow Charts, Pumping of Sewage.

ASSESSMENT:
Continuous: Two Mid-Term tests and make-up test if required.
Semester-end: Theory examination of 3 hours.

CO OF PRACTICAL'S

Students will be able to

CO1: Analyze physical and chemical quality parameters of water and wastewater samples according to Indian standards, and determine their suitability for drinking and required treatment levels.

CO2: Quantify bacterial content in water and wastewater samples, and understand bacteriological media used for culturing microorganisms.

CO3: Demonstrate knowledge of Indian standards related to drinking water, effluents, and river water quality

Mapping of CO with PO

CO	**P01**	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**P010**	**P011**	**P012**
C01	3	0	0	0	0	0	0	0	2	2	0	2
C02	3	0	0	0	0	0	0	0	2	2	0	2
Target	**3**	**0**	**0**	0	0	0	0	0	**2**	**2**	0	**2**

List of Experiments:

1. To determine the pH value of given sample of water. TO calculate the dose of chemical for adjusting the pH to a specific value for treating 10 MLD of water.
2. To determine the amount of Acidity of a given sample of water
3. To determine the amount of Alkalinity of a given sample of water
4. To determine the amount of Chlorides of a given sample of water
5. To determine the total hardness, calcium hardness and magnesium in given sample of water.
6. To determine the amount of Dissolved Oxygen of a given sample of water
7. To determine the amount of total dissolved and suspended solids sample of water.
8. To determine the Chemical Oxygen Demand (C.O.D.) of a given sample of sewage.
9. Determination of Biological Oxygen demand of a waste water sample.
10. To prepare liquid and solid nutrient media.
11. To determine Coliform bacteria concentration by Most Probable Number (M.P.N.) method in a water/wastewater sample.

12. To determine Coliform bacteria concentration by Membrane Filtration Technique (M.F.T) method in a water/wastewater sample.

Assessment:

Evaluation on experiments performed & laboratory manual, internal submission and Viva Voice examination by internal examiner.

Semester-end: Practical Viva Voice Examination by external examiner.

Books & References Recommended:

Text Books

1. Punmia,B.C., "Water Supply Engineering" Laxmi Publications(P) Ltd.,New Delhi. 2016,2nd edition.

2. Punmia,B.C., "Waste Water Engineering" Laxmi Publications(P) Ltd.,New Delhi.2017.1st edition.

3. Garg,S.K. "Water Supply Engineering" Khanna Publishers,Delhi.2017-2018,9th edition.

4. Garg,S.K. "Sewage Disposal and Air Pollution Engineering" Khanna Publishers,Delhi.2017-2018,9th edition.

5. Birdi G.S. & Birdie,J.S. " Water Supply and Sanitary Engineering" Dhanpat Rai Publishing Company(P) Ltd.,New Delhi.9th reprint.2016.

Reference Books

1. Hammer,Mark J. & Hammer Mark J.,Jr. " Water and Wastewater Technology" PHI Learning Private Limited,New Delhi.2009.6th edition.

2. Modi Dr. P. N. "Water Supply Engineering", Standard Book House, Delhi, Third edition,2010.

3. Modi Dr. P. N. "Sewage Treatment & Disposal and Wastewater Engineering", Standard Book House, Delhi, Second edition,2008.

4. Bhave P. R., Gupta R. "Analysis of water distribution networks" Narosa publishing house, 2012.

5. NEERI Nagpur & NICD, Delhi. "Guidance Manual for Drinking Water Quality Monitoring and Assessment" Second edition, June 2010.

6. Rice, E.W., Baird R. B., Eaton A.D. "Standard Methods for the examination of Water and Wastewater" APHA, AWWA, Water Environment Federation, 23rd edition, 2017.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. III Year (4YDC)
CE31003 DESIGN OF RCC STRUCTURES

CREDITS:

HOURS PER WEEK			CREDITS			MAXIMUM MARKS				
						THEORY		PRACTICAL		TOTAL MARKS
T	P	Tu.	T	P	Tu.	CW	END SEM	SW	END SEM	
3	2	-	3	1	-	30	70	40	60	200

Pre-Requisite:

1. Strength of Materials
2. Structural Mechanics

COURSE OBJECTIVES:

Objectives in studying this course are to

1) Understand the basic concepts of Limit state design & Working Stress Design.
2) Obtain the knowledge of using Indian standard codes and special publication.
3) Apply the design concepts of all the structural members and learn economical designfor materials saving.
4) Analyse and design RCC beams, slabs, column, footings, staircase and retaining wall.

COURSE OUTCOMES:

Students will be able to

1. Explain and describe the behaviour of RCC Structure
2. Calculate Axial, Shear and Moment of resistant of RCC structures i.e. Beams, column.
3. Design and detail the RCC Slab, Beam, Column, Footing, Staircase and Retaining wall
4. Use and apply IS:456-2000 and SP16
5. Analyse, design and Detail R.C.C. Retaining wall & Stair case.

Mapping of CO with PO

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	3	3	3	0	0	2	0	0	0	0	0	0
C02	3	3	3	0	0	2	0	0	0	0	0	0
C03	3	3	3	0	0	2	0	0	0	0	0	0
C04	3	3	3	0	0	2	0	0	0	0	0	0
C05	3	3	3	0	0	2	0	0	0	0	0	0
Target	**3**	**3**	**3**	0	0	**2**	0	0	0	0	0	0

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:
Theory
Unit – 1
Introduction: Working Stress, Design Method, Assumptions and Permissible Stresses**, Working Stress Design Method:** Assumptions, Distribution of Stresses and Transformed Area, Rectangular Beam Section, Analysis and Design of Singly and Doubly reinforced sections T and inverted L-beam section-Analysis and Design of Singly and Doubly Reinforced Sections, use of Design Aids.
Reinforcement Detailing: Requirement governing Reinforcement Detailing, Curtailment of Tension and Compression Reinforcement, Spacing of Reinforcement and Diameter of Reinforcement and Cover to Reinforcement. Requirement of Reinforcement in Structural Members.

Unit – 2

Limit State Method, Safety and Serviceability requirements, Characteristics and Design Value, Partial Safety Factor, Limit State of Serviceability, Deflection and Cracking.
Limit State Method of Design: Assumptions, Rectangular Beam Section, Analysis and Design of Singly and Doubly Reinforced Section Design of T and inverted L Sections, Use of Design Aids.
Shear: Behaviour of R.C. Beam in Shear, Design of Shear Reinforcement by Limit State, Method.
Bond: Nature of Bond between Concrete and Reinforcing Bars, Design Bond Stress Based on Limit state Method.
Torsion: Design of Beams in torsion, limit state method.

Unit – 3

Slab: One-way Solid Slab, Simply Supported and Continuous Slabs, Slab Spanning in Two directions at right angles, Sabs carrying concentrated loads, Load carried by supporting beams, Permissible shear stress in Solid Slabs, Sketching of Reinforcement in Solid Slabs.
Stair Case: Types of Staircases, Inclined and Cantilever, Effective Span of Stairs and distribution of Loading, Analysis and Design of Stairs.

Unit – 4

Compression Members: Classification, Pedestal, Long and Short Column. Design of Short Columns, Long Columns and Helical Columns - Limit State method, Eccentrically Loaded Columns.
Footing: General types, Structural behaviour and Design approach. Footing for Walls, Isolated column footing, Combined Rectangular and Trapezoidal Footings and Combined Strip Footing.

Unit – 5

Retaining walls- General types, Structural behaviour, Design of Cantilever Retaining Walls and counter fort retaining Walls.

ASSESSMENT:
Continuous: Two Mid-Term tests and make up test if required.
Semester-end: Theory examination of 3 hours.

CO OF PRACTICAL'S

1. Design and detail various Elements of R. C. C. Structure.
2. Design and detail a Small R. C. C. building

PRACTICALS:
List of experiments: Preparation of drawing and design of following structures:

1) Design & detailing of Rectangular Beams - Singly Reinforced & Doubly Reinforced.
2) Design & detailing of Flange Beams - T & L Beam.
3) Design & detailing of Continuous & Cantilever Beams.
4) Design & detailing of One-way Slabs.
5) Design & detailing of Two-way Slabs.
6) Design & detailing of Short Axially loaded Column – Square, Rectangular & Circular.
7) Design & detailing of Long Column subjected to Uniaxial & Biaxial Moments.
8) Design & detailing of Isolated Footings – Rectangular, Trapezoidal, Stepped, Circular.
9) Design & detailing of Footings – Combined, Raft, Strip & Strap.
10) Design & detailing of Stair cases
11) Design & detailing of Retaining Walls- Cantilever & Counterfort.

CO PO Mapping of Practical CE31003													
CE31003 DESIGN OF RCC STRUCTURES	**CO**	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
	C01	3	0	0	0	0	0	0	0	2	2	0	2
	C02	3	0	0	0	0	0	0	0	2	2	0	2
	Target	**3**	**0**	**0**	0	0	0	0	0	**2**	**2**	0	**2**

ASSESSMENT:
Continuous Evaluation of Drawing Sheets & Design Calculations, internal submission and Viva-Voce examination by internal examiner.
Semester-end: Practical Viva Voce Examination by external examiner.

Book & References Recommended:
Text Books

1) Jain O. P. & Jaikrishna, "Plain Reinforced Cement Concrete", Nemchand Bros., Roorkee.
2) Jain A.K., "RCC Design", Nemchand Bros., Roorkee.
3) R.C.C Design by H. J. Shah, Charotkar publication.
4) R.C.C Design by Pillai Menon, TMH Publication.
5) R.C.C Design by P.C Varghese, published by Prentice-Hall of India.
6) Subramanian, N. "Design of Reinforced Concrete Structures", Oxford University Press, New Delhi, 2013.

7) Punmia B.C., *R.C.C. Designs, Laxmi Publication New Delhi Edition 10th 2015.*

Reference Books

1) Krishna Raju N., *R.C.C. Design,CBS Publisher New Delhi Edition 2nd.*
2) Park and Paulay, *Design of R.C.C. Structures, Wiley publication New York 1975.*
3) Sinha S.N., *R.C.C. Design, Tata McGraw-Hill Education New Delhi Edition 3rd 2014.*
4) Syal & Goyal, *Design of Reinforcement Concerete,S.Chand&Company New Delhi Edition 3rd 2013.*
5) Mallick S. K. & Gupta A.P., "Reinforced Concrete",Oxford I B H.
6) Dayaratnam P., RCC *Design by Limit State,Oxford & Ibh-Pubs Company-New Delhi Edition 4th.*
7) Vazirani & Ratwani, Design of *R.C. Structures, Khanna Publishers New Delhi Edition 16th.*

B. E. III YEAR (4YDC)

CE31007: STRUCTURAL ANALYSIS I

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
3	-	1	4	-	-	CW	END SEM	SW	END SEM	100
						30	70	-	-	

Pre-Requisite: Strength of Materials, Structural Mechanics.

COURSE OBJECTIVES: The course aims to develop skills of students in analyzing indeterminate structures. It covers various methods of displacement calculation, strain energy concepts, analysis of indeterminant beams/truss/frames, influence lines, and specialized structures like arches and suspension bridges. Students will learn to differentiate between determinacy/indeterminacy and stability/instability, applying these concepts to solve diverse structural engineering problems.

COURSE OUTCOMES:

After studying this subject thoroughly, students shall be able to:

1. Differentiate between determinacy/indeterminacy and Stability/Instability. Compute displacements using different method and analysis of indeterminate structures using compatibility conditions.
2. Analyze the two-degree indeterminate problems using the concept of strain energy.
3. Analyze fixed and continuous beams under different loading and support movements.
4. Illustrate the influence lines and rolling loads for beams, trusses, and bridges.
5. Analyze and draw ILD for arches, cables and suspension bridges.

Mapping of CO with PO:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	0	0	3	0	0	0	0	0	0
CO2	3	3	2	0	0	3	0	0	0	0	0	0
CO3	3	3	2	0	0	3	0	0	0	0	0	0
CO4	3	3	2	0	0	3	0	0	0	0	0	0
CO5	3	3	2	0	0	3	0	0	0	0	0	0

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

Course Content: Theory

Unit - 1

Types of Structures, Different types of loading and supports, Static and Kinematic Indeterminacy, Displacement computation for beams and trusses using real work and virtual work method, Displacement due to lack of fit, temperature variation, support movements. Method of Consistent Deformation (Force Method) for Beams, Frames and trusses.

Unit - 2

Least Work Method for analysis of Redundant Beams, Trusses and Frames upto Two-degree Indeterminacy. Effect of Temperature, Lack of Fit, Support Movements on indeterminant trusses.

Unit - 3

Analysis of Fixed beam using Area Moment Method and Continuous Beams using Three Moment Theorem subjected to different kind of loadings. Effect of Partial Fixity and settlement of Supports.

Unit - 4

Influence lines for Beams, Trusses and Arches, Rolling Loads on Bridges - Absolute Maximum Shear Force and Bending Moment.

Unit - 5

Three Hinged Arches: Horizontal Thrust, Radial Shear, Normal Thrust, BMD. Influence Lines Diagrams: Arches, Cables and suspension bridges, Two-hinge & three-hinge stiffened suspension bridges.

ASSESSMENT:

Continuous: Two Mid-Term tests and make up test if required.

Semester-end: Theory examination of 3 hours.

Books & References Recommended:

Text Books

1. Reddy C.S., Basic Structural Analysis.,Tata Mcgraw-hill publication., New Delhi
2. S. Ramamrutham., Theory of Structure., Dhanpat Rai Publishing Company; ninth edition (1 January 1973)
3. R. L. Jindal., Indeterminate Structures., S. Chand Publication., 4th Edition., 1994
4. Punmia et.al. Theory of Structure, Laxmi Publications, New Delhi
5. G. S. Pandit and S. P. Gupta., Structural Analysis – A Matrix Approach., 2nd Edition., Tata Mcgraw-hill Education Private Limited., New Delhi

Reference Books

1. Wilber J.B. and Norris C.H., Elementary Structural Analysis, Tata McGraw-Hill
2. Kinney J.S., Indeterminate Structural Analysis, Oxford IBH Publishing.
3. Gere J. Mad, Weaver W., Analysis of Framed Structures, D. Van Nostrand Co.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT

B. E. III YEAR (4YDC)

CE31010 : WATER RESOURCES ENGINEERING

CREDITS:

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
3	2	-	3	1	-	CW	END SEM	SW	END SEM	200
						30	70	40	60	

Pre-requisite: Fluid mechanics

COURSE OBJECTIVES: -

1) To understand the water requirements of various types of crops.
2) To understand the different types of irrigation systems.
3) To plan the reservoir systems as per the requirements.
4) To understand the concepts of Khosla's and Bligh's theory & its applications.
5) To understand the concepts of Lacey's and Kennedy theory for design of canal systems.
6) To develop an understanding of various components of hydrological cycle, their behaviors & factors affecting it & solve problems on measurement on rainfall, infiltration, evaporation.
7) To understand concepts of Hydrometry & ground water hydrology.
8) To discuss the importance of estimation of runoff, analysis of rainfall data and various hydrographs and analyze various problems off runoff using various hydrograph theories.
9) To develop an understanding of various methods of flood estimation in general & flood frequency.

COURSE OUTCOMES:

1. Apply the concepts of soil water plant relationship to generate the crop water requirements
2. Design irrigation canals and canal network.
3. Classify the different types of irrigation structures along with their components, functions and types.
4. Analyse various components of the hydrological cycle, concepts of runoff and floods etc., estimate runoff by different methods.
5. Analyse hydrologic flood routing models. Compute yield from surface and subsurface basin. The assessment of available water is also described with detailed concept of hydrologic analysis including precipitation analysis, rainfall Runoff process, and design

flood estimation along with hydrograph analysis. Further introduction to various hydraulic structures is given along with detailed design concepts of earthed channels.

Mapping of CO with PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	0	0	0	0	0	2	0	0	0	0	0
CO2	3	2	0	0	0	0	0	0	0	0	0	0
CO3	2	3	0	0	0	0	0	0	0	0	0	0
CO4	2	3	0	0	0	0	2	0	0	0	0	0
CO5	3	1	1	0	0	0	0	0	0	0	0	0
Target	2.6	1.8	0.2	0	0	0	0.8	0	0	0	0	0

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:
Theory :

Unit - 1
Introduction: Occurrence of Natural Water, Sources of Water, Surface and Sub-surface sources, Quality and Quantity of different sources.
Irrigation Engg. Definition, Need, Scope & Types of Irrigation, Water Application Methods, Soil-Water Plant relationship and Assessment of Irrigation requirements. Quality of Irrigation Water, Rotation of Crops.

Unit - 2
Irrigation Schemes, Direct & Storage Schemes, Canal Systems, Planning & Layout of a Canal System, Design of Canals, Regime concept & Tractive force Method of Channel Design, Channel Losses, Canal lining, Design of Lined Channel Section Water Logging, Causes & Effects, Remedial Measures, Salinity, Land Reclamation, Drainage.

Unit - 3
Elements of Storage & Diversion Schemes, Components, Types of Dams, Classification, Gravity & Earth Dams, Types of Weirs, Introduction to: Spillways, Energy Dissipation Devices, Canal Regulation Structures like Head & Cross Regulations, falls, Gross Drainage works, Escapes, Outlets, Their Need, Functions Sketches. Reservoir Planning, Investigations, Reservoir Capacity Safe Yield, Life of Reservoir.

Unit - 4
Hydrology : Definition, Hydrological Cycle, Precipitation, Evaporation, Infiltration, Runoff, Estimation of Runoff, Empirical Formulae, Rainfall-Runoff relationships, Hydrometry, Methods of Stream Gauging, Rating Curves, Ground Water: Elements of Ground Water Hydrology, Well Hydraulics, Equations of Ground Water flow, Solutions and applications, Concepts of Artificial Recharge.

Unit – 5

Hydrographs & Hyetographs, Hydrographs Analysis, Unit Hydrographs, Methods of constructing Unit Hydrographs, Synthetic U.H., Summation Hydrograph, Design Storm Design Flood by U.H.

ASSESSMENT:

Continuous: Two midterm tests in a semester and a makeup test if required.
Semester-end: Theory examination of 3 Hours duration.

PRACTICALS:

List of Experiments:

Section A: EXPERIMENTS IN HYDROMETEROLOGY/HYDROLOGY

1. Study of various hydrometeorological instruments.
   (a) self-recording rain gauge.
   (b) Pan evaporimeter.
   (c) Lysimeter
   (d) Lab infiltrometer
   (e) Rainfall simulator
2. Determination of pan evaporation.
3. (a) calibration of lysimeter (b) determination of components of hydrological cycle using lysimeter.
4. Infiltration experiment.
5. (a) measurement of rainfall intensity and uniformity by rainfall simulator.
   (b) measurement of splash erosion by rainfall simulator.
   (c) measurement of wash off erosion by rainfall simulator.
6. Flood routing.

SECTION B: EXPERIMENTS ON HYDRAULICS/HYDRAULIC STRUCTURES

2. Study of adjustable hydraulic flume.
   (a) specific energy curve plotting
   (b) study of hydraulic jump
   (c) friction blocks
   (d) venturi flume experiment
   (e) study flow over structures : sharp crested weir,broad crested weir and ogee weir
   (f) calibration of sharp-crested weir, broad-crested weir and ogee weir
   (g) horizontal expansion in a channel
3. Study of four meters adjustable hydraulic flume.
   (a) vertical contraction in a channel
   (b) horizontal contraction in a channel
   (c) vertical fall
4. Study of turbulent flow apparatus
5. Electrical analogy method for drawing flow-nets
6. Flow meter in a channel: broad crested weir

ASSESSMENT:
Continuous: Evaluation of design calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner.

Semester-end: Practical Viva Voice Examination by external examiner.

Books Recommended:

Text Book:

1. Punmia B.C. &PandeB.B.Lal : *Irrigation & Power Engg.,Laxmi Publication (P) LTD. 16th Edition 2016*
2. Subramanya K., *Engg. Hydrology,Tata McGraw-Hill Education. 4th Edition 2015*
3. Garg S.K.: Water *Resources Engg., Khanna publication. 3rd Edition2010.*

Reference Books:

1.Chow V.T. (ed) H.J., *Book of Applied Hydrology,McGraw Hill Education (India) Private Limited. 2nd Edition 2010*
2.Micheal A., *Irrigation Theory &Practice,Vikas Publishing House Pvt. Ltd., 2nd Edition 2009*
3.Raghunath H.M., *Ground Water, New Age International.3RD EDITION 2011*

B. E. III YEAR (4YDC)
CE31201: ADVANCE HIGHWAY AND AIRPORT ENGINEERING

Syllabus with Course Outcomes (COs)

CREDITS:

HOURS PER WEEK			CREDITS			MAXIMUM MARKS				
						THEORY		PRACTICAL		TOTAL MARKS
T	P	Tu.	T	P	Tu.	CW	END SEM	SW	END SEM	
3	2	-	3	1	-	30	70	40	60	200

PRE-REQUISITE:

1. Transportation Engineering

COURSE OBJECTIVES:

Through this course testing of materials used in rigid and flexible pavements, their component parts, their design and construction methodology will be studied in detail. The maintenance of roads, its drainage & use of IRC codes will be studied by students.

COURSE OUTCOMES (CO):

Students will be able to

1. Understand the different properties of highway materials.
2. To solve the problems for design of flexible and rigid pavement.
3. Analyze the various factors affecting pavement design and its methods.
4. Understand the aircraft characteristics and apply them in airport planning, step wise procedure of highway construction and its maintenance activities.
5. Determine the airport layout and structural design of airport pavements.

Mapping of CO with PO

CO PO MAPPING OF COURSE CE31201 THEORY												
CO \ PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	0	0	0	0	0	0	0	0
CO2	3	3	2	2	0	0	0	0	0	0	0	0
CO3	2	2	3	3	0	3	0	0	0	0	0	0
CO4	2	2	3	2	0	2	0	0	0	0	0	0
CO5	2	3	3	3	0	2	0	0	0	0	0	0

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

THEORY

Section A:

Unit - 1 Highway Engineering: Highway Materials: Soil, Desirable Properties, Classification, CBR, G. I. Modulus of Subgrade Reaction, Aggregates and their Characterisations, Bitumen Types, Tests on Bitumen, Bituminous Mixes-Requirements and Design, Concrete Mixes-Design, I.R.C. - 44 Method, Road Note No. 4 Method, ACI., Guidelines by I.S.

Unit - 2 Pavement Design: Pavement Structures, Wheel Load Configuration, Behaviour under Repeated Loading, Function of Various Pavement Components, Factors affecting Pavement Design, Flexible Pavement Design Methods-GI, CBR, California R-Value Method. Triaxial Method, Mcleod Method, Burmister Method, I.R.C. Method Rigid Pavements, Calculation of Wheel Load Stresses and Temperature Stresses, Westergaard Method, Analysis, Joints in Rigid Pavements, I.R.C. Method for Design, Filling and Sealing of Joints, Design of Reinforcement, Dowel Bars and Tie Bars, Pumping of Concrete Pavements.

Unit - 3 Construction of Pavement: Highway Constructions - Earth Roads, Gravel roads, Soil Stabilized Roads, WBM Roads, Bituminous roads. Surface dressing, Seal Coat, Tack Coat, Prime Coat, Grouted Macadam, Premix Methods and their Construction Procedures Construction of Cement Concrete Pavement Slab. Evaluation and Strengthening: Flexible and Rigid Pavement Evaluation, Strengthening of Pavements, Design of Overlays- Based on Benkelman Beam Deflection Method.

Section B:

Unit - 4 Airport Planning: Regional Planning, Topographical and Geological Features, Air Traffic Characteristics, Development of New Airports, Airport Site Selection. Aircraft Characteristics: Size, Capacity, Range, Speed, Components of Aircraft, Different Weights Related with Aircraft, Turning Radius. Airport Obstruction: Zoning Laws, Classification of Obstructions, Imaginary Surfaces, Approach Zones, Turning Zones.

Unit - 5 Airport Layout: Runway Orientation, Wind Rose Diagram, Basic Runway Length, Correction for Runway Length, Airport Classification, Geometric Design, Airport Capacity, Runway Configuration, Taxiway Design, Factors Affecting, Geometric Standards, Exit Taxiways, Holding Aprons, Location of Terminal Buildings and Aircraft Hangers. Structural Design of Airport Pavements: Design Factors, Design Methods for Flexible and Rigid Pavements, LCN System. Visual Aids: Airport Marking and Lighting, Threshold Lighting, Runway Lighting and Taxiway Lighting Runway Marking and Taxiway Marking. Introduction to Airport Drainage System.

ASSESSMENT:
Continuous: Two Mid-Term tests and make up test if required.

Semester-end: Theory examination of 3 hours.

CO OF PRACTICAL'S

1. Master the evaluation of physical properties of aggregates.
2. Analyze the mechanical properties and durability of aggregates.
3. Understand the rheological properties and behavior of bituminous materials.
4. Develop expertise in designing bituminous concrete mixes and road drainage systems.
5. Evaluate pavement performance and design rehabilitation strategies

Mapping of CO with PO

CO PO MAPPING OF COURSE CE31201												
CO \ PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	0	0	0	0	0	0	0	2	2	0	2
CO2	3	0	0	0	0	0	0	0	2	2	0	2
CO3	2	0	0	0	0	0	0	2	2	2	0	3
CO4	2	0	0	0	0	0	0	2	3	2	0	3
CO5	2	0	0	0	0	0	0	2	2	2	0	3

PRACTICALS:
List of experiments: Preparation of drawing and design of following structures:

1. To find out grain size distribution of coarse aggregates.
2. To determine fineness modulus of aggregates
3. Determination of specific gravity and water absorption of coarse aggregates
4. To determine angularity number, flakiness index and elongation index of given sample
5. To determine crushing value of aggregates
6. To determine impact value of aggregates
7. To determine abrasion value of aggregates
8. To determine stripping value of aggregates
9. Soundness test on aggregates.
10. To determine fineness modulus of fine aggregates
11. Determination of specific gravity of fine aggregates
12. To determine material finer than 75-micron IS sieve present in the aggregate by washing.
13. Determination of necessary adjustment for the bulking of fine aggregate by field method and to draw curve between water content and bulking
14. To determine % of fine sand to get desired F.M when F.M of fine and coarse sand is known

15. To design drainage for roads
16. To determine penetration value of given sample of bitumen
17. To determine ductility value of given sample of bitumen
18. To determine softening point of given sample of bitumen
19. To determine specific gravity of given sample of bitumen
20. To determine viscosity of given sample of bitumen.
21. To design a bituminous concrete mix by Marshall Stability method.
22. To find out the proportion of bitumen and aggregate in bituminous concrete mix.
23. Determinations of rebound deflection of flexible pavement under static load of the real axle of a standard truck with the help of Benkelman beam and design the overlay thickness by CGRA method.

Book & References Recommended:

Text Books

1. Khanna S.K. & Justo, C.E.G. "Highways Engineering" 10th edition. Nem Chand and Brothers, 2015.
2. Kadialy L.R.," Traffic Engg. and Transport Planning", 8thedition, Khanna Publishers, 2011.
3. M. W. Witczak E. J. Yoder., Principles of Pavement Design,Wiley, 2nd edition, India Pvt. Ltd.-New Delhi, 2008.
4. HMSO, "Bituminous Material in Road Construction", H.M.S.O. (London) Publication.
5. HMSO, "Concrete Roads: Design and Construction",H.M.S.O. (London) Publication.
6. Hornjeff Robert, Planning and Design of Airport, 5th edition, Mcgraw-hill, 2010.
7. Khanna & Arora, "Airport Planning and Design", Nem Chand & Brothers Publication, 1999.

Reference Books

1. IRC-58-2015, "Guideline for Design of Rigid Pavements".
2. IRC-37-2018, "Guideline for the Design of Flexible Pavements".
3. IRC-15-2011, "Standard Specifications and Code of Practice for Construction of Concrete Roads".
4. IRC-81-2014, "Tentative Guidelines for Strengthening of Flexible Road Pavement Using Benkelman Beam Deflection Method".
5. Specification for Road and Bridge Works (Ministry of Surface Transport - Published by Indian Roads Congress.
6. IRC-44-2008-"Tentative Guidelines for Cement Concrete Mix Design".

SEMESTER VI

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. III year (4YDC)
CE31502 DESIGN OF STEEL STRUCTURES

CREDITS:

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu.	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
4	2		3	1		CW	END SEM	SW	END SEM	200
						30	70	40	60	

Pre-Requisite:

1. Strength of Materials
2. Structural Mechanics
3. Structural Analysis

COURSE OBJECTIVES:

1) To describe the behaviour and design of structural steel.
2) To provide comprehensive experience in the design of various elements of steel structures using limit state design methodology.
3) To demonstrate the principles, procedures and current code requirements to the design of steel structural members & its connections.
4) To discuss the basic concepts of Plastic Analysis.
5) To outline the design concepts of all the structural steel members and learn economical design.

COURSE OUTCOMES: Upon completion of this course, the student will be able to

1) Summarise the behaviour and design different types of steel connections.
2) Compute the design loads for various types of structures.
3) Illustrate the design of compression member, tension member and flexure members.
4) Analyse & design the Plate girder.
5) Develop complete drawings of steel structures including all details of members, sections and their connections.

Mapping of CO with PO

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	3	3	3	0	0	0	0	0	0	0	0	0
C02	3	3	3	0	0	0	0	0	0	0	0	0
C03	3	3	3	0	0	0	0	0	0	0	0	0
C04	3	3	3	0	0	0	0	0	0	0	0	0
C05	3	3	3	0	0	0	0	0	0	0	0	0
Target	**3**	**3**	**3**	0	0	0	0	0	0	0	0	0

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory :

Unit - 1

Structural Design And Their Preparation: Different types of Structural Steel Products, Their designation.

Connections: Riveted and Bolted Connections, Lap and Butt Joints Bracket Connection, Flange Plate Connections, Beam and Built up Beams and Columns, Beam Column Connections, Beam and Column splice connection through sketches, Assumptions in Bolted and Riveted Connections, Possible failure of Rivets or Joints, Rivet and rivet Values, Efficiency of Joints, Design of Simple Connections with Butt and Fillet Welds, Connection with Eccentric Loads, Moment Resisting Connections.

Unit — 2

Tension Members: Various section for Tension Members, Calculation for Net Area, Permissible stresses, Members subjected to Tension and Bending.

Compression Members: Various sectional shapes for Compression Members Slenderness Ratio, Permissible Stresses, Members subjected to both Bending and Axial Compression.

Roof Trusses: Different Types of Roof Trusses, their advantages, Dead, Live and Wind Loading, Bracing requirements, Corrugated sheeting, Purlin design, Analysis of Trusses, Design forces, Design of Members and Connections.

Unit — 3

Flexure Members: Various sections used for Flexure Members, Permissible stresses, Design of Beams, Lateral Buckling, Web Buckling and Crippling under Concentrated Loads, Lateral buckling of Beams, Use of Stiffeners.

Method of Plastic Analysis: Lower Bound and Upper bound Theorems, Static & Kinematic method, mechanisms method, Combined mechanism, Analysis and Design of Beams, Frames, Collapse Modes and Possible Moment Distribution.

Unit — 4

Column and Foundation: Compression members , Importance of slenderness ratio in design of columns, Design of columns using single sections and built up section, design of lacing and battens, Various types steel foundation and Design of Columns Bases, Slab Base, Gusseted Base and Grillage Foundations

Unit - 5

Built Up Girders: Design of Built-up Beams, Riveted and Welded Plate Girders, Curtailment of plates. Vertical, Horizontal and Bearing Stiffeners and their Connections.

ASSESSMENT:

Continuous: Two Mid-Term tests and make up test if required. Semester-end:
Theory examination of 3 hours.

CO of Practical's

1) Design and detail various Elements of Steel Structure.
2) Design and detail a Small steel building

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	2	0	0	0	0	0	0	0	3	3	0	3
C02	2	0	0	0	0	0	0	0	3	3	0	3
Target	**2**	**0**	**0**	0	0	0	0	0	**3**	**3**	**0**	3

PRACTICALS:

List of experiments: Preparation of drawing and design of following elements:

(1) Design of Section.
(2) Design of Connections — Bolted & Welded.
(3) Design of Tension Members.
(4) Design of Compression Members Simple Column, Built-up Column. Lacing & Battens.
(5) Design of Gusseted & Slab base.
(6) Numerical Problems on Plastic Analysis.

ASSESSMENT:

Continuous Evaluation of Drawing Sheets & Design Calculations, internal submission and Viva-Voce examination by internal examiner.
Semester-end: Practical Viva Voce Examination by external examiner.

Book & References Recommended:

Text Books

l) Ramchandra. S. , Virendra Ghelot, "Design of Steel of Structures", Volume 1, Scientific Publishers, New Delhi, 2011.

2) Duggal .S.K. "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, New Delhi, 2nd Edition, 2014. 3) Bhavikatti S. S. "Design of Steel Structures by Limit State Method as Per IS: 800 2007", 1. K. International Pvt. Ltd., 2009.

4) Subramanian, N. "Steel Structures - Design and Practice", Oxford University Press, 2011.

Reference Books

1. Negi L.S., Design of Steel Structures, McGraw-Hill Education New Delhi Edition 2nd 2008.
2. Chandra R., Design of Steel Structures Vol. I. , Scientific Publishers Jodhpur (2012)
3. Arya & Ajmani, Design of Steel Structure, Nem Chand and Bros. Roorkee Edition 5th 2001.
4. Gambhir M.L.,Fundamentals of Structural Steel Design, TMH Publication New Delhi Edition 1 st 2011.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. III year (4YDC)
CE 31505: STRUCTURAL ANALYSIS-II

CREDITS:

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
4	2	-	3	1	-	CW	END SEM	SW	END SEM	200
						30	70	40	60	

Pre-Requisite: Strength of Materials, Structural Mechanics.

COURSE OBJECTIVE:

1. To determine the forces in indeterminate arch and be able to draw ILD for the arches.
2. To determine forces in indeterminate structure
3. To construct influence lines and be able to use them for the calculation of forces.

COURSE OUTCOMES:

Students will able to

1. Identify suitable method to solve indeterminate structures.
2. Calculate the forces in member by the displacement and force methods.
3. Describe the structural behavior based on the results of analysis.
4. Determine the bending moment diagram and shear force diagram of determinate and indeterminate structures.
5. Assess the formation of plastic hinges in the structure.

Mapping of CO with PO

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	0	2	0	0	0	0	0	0
CO2	3	3	3	3	0	2	0	0	0	0	0	0
CO3	3	3	3	3	0	2	0	0	0	0	0	0
CO4	3	3	3	3	0	2	0	0	0	0	0	0
CO5	3	3	2	2	0	2	0	0	0	0	0	0

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit - 1

Indeterminate Arches: Two hinged arches, Unit load method and Column Analogy Method of analysis. Influence Lines for horizontal thrust, Radial Shear and Normal Thrusts. Fixed Arches. Development of Method of Elastic Centre for Analysis. Effects of Rib-Shortening Temperatures on Arches.

Unit – 2 Conventional Methods

Slope-Deflection Method: Slope-deflection equations. Application to indeterminate Fixed and Continuous beams and Portal frames withVertical and Inclined legs.

Moment Distribution Method: Development of Method of Moment Distribution. Application to Beams and Portal Frames. Analysis of Multibay Multi-storeyed frames and Frames with Gable Top.

Kani's Method of Analysis: Development of Method. Applicationto Portal Frames a, Multibay, and Multi-storeyed Frames.

Unit – 3

Matrix Method of Analysis: Introduction to Matrix Algebra. Flexibility and Stiffness Coefficient, Direct Stiffness Method. Energy approach, Flexibility Method, Analysis of beams and frames using stiffness method.

Column Analogy Method: Introduction, Development of method, Analysis of frames beams with varying cross section and by Column Analogy Method.

Unit - 4

Influence Lines For Indeterminate Structures: Reciprocal Theorem, Influence Co- efficient, Muller-Breslau's Theorem. Influence Lines for Reactions and Moments inarches, Continuous Beams, Fixed Beams, Simple Portal Frames etc. Maxwell Betti's Theorem. Use of Begg's deformation for Experimental Method.

Unit – 5

Plastic Analysis and Design: Stress-strain curve of steel. Theory ofPlastic Bending and Plastic Hinge Formation. Redistribution of moments and Plastic Analysis. Static and Kinematic method of Analysis.

Introduction to Finite Element Method: Steps, Comparison with Other Methods.

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required.

Semester-end: Theory examination of 3 Hours duration.

PRACTICALS:
CO OF PRACTICAL'S

CO1: Analyze and experimentally determine horizontal thrust and influence line diagrams (ILDs) for various structural elements including arches and portal frames.
CO2: Apply the Beggs deformation method to study experimental influence line diagrams and interpret the results.
CO3: Calculate and graphically represent influence line diagrams for support reactions, moments, shear forces, and bending moments in beams and arches of different configurations.
Mapping of CO with PO

CO PO Mapping of Practical CE31003													
CE31003 DESIGN OF RCC STRUCTURES	**CO**	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
	C01	3	0	0	0	0	0	0	0	2	2	0	2
	C02	3	0	0	0	0	0	0	0	2	2	0	2
	Target	**3**	**0**	**0**	0	0	0	0	0	**2**	**2**	0	**2**

List of experiments:

(1) Experimental study of horizontal thrust and its ILD for a two hingedparabolic arch.
(2) Experimental study of horizontal thrust and its ILD for a two hinged circulararch.
(3) Experimental study of horizontal thrust and its ILD for a two hinged portalframe.
(4) Experimental study of horizontal thrust and its ILD for a fixed hinged portalframe
(5) Study of beggs deformation for experimental ILD.
(6) Calculation and drawing of ILD for support reaction and momentand BM and SF at intermediate point of a fixed beam.
(7) Calculation and drawing for support reactions and moments and BM and SF at an intermediate point of a two span continuous beam.
(8) Calculation and drawing of ILD for horizontal thrust ,NT, RS and BM for two hinged parabolic ARCH.
(9) Calculation and drawing of ILD for horizontal thrust ,NT, RS and BM for two hinged circular ARCH.

Assessment:

Continuous: Evaluation of calculations & drawing sheets, internal submissionand Viva Voce examination by internal examiner.
Semester-end: Practical Viva Voce Examination by external examiner.

Books &Reference Recommended:

Text books:

1. Reddy C.S., Basic Structural Analysis, TMH New Delhi, 3rd Edition, 2011.
2. Ramamurtham, Theory of Structure, Dhanpat Rai New Delhi, Edition 2015
3. Punmia B.C., Strength of Material and Mechanics of Structure, Vol. II, Standard Publishers Distributors, 12th Edition, 2004.
4. Jindal R.S., Indeterminate Structural Analysis, Addison-Wesley Publishing Co New York 1958.
5. Pandit and Gupta, Structural Analysis (A Matrix Approach), Tata McGraw-Hill Education New Delhi, 2nd Edition, 2008.

Reference books:

1. Gere J. Mad, Weaver W., Analysis of Framed Structures, D. Van Nostrand Co., 3rd Edition, 1990.
2. Chu-Kia Wang, Intermediate Structural Analysis, McGraw Hill Education (India) Private Limited, Edition 2010
3. Kinney J.S., Indeterminate Structural Analysis, Addison-Wesley Publishing Co New York 1958

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. III year (4YDC)
CE31506 CONSTRUCTION TECHNOLOGY-II

CREDITS:

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu.	T	P	Tu.	THEORY		PRACTICAL		TOTAL MARKS
4	2	-	3	1	-	CW	END SEM	SW	END SEM	200
						30	70	40	60	

Pre-Requisite:

1. Building Planning and Drawing
2. Construction Technology-I

COURSE OBJECTIVES:

This course will enable students to:

1. Study the types of Estimates and different techniques of estimation for different projects.
2. Develop the knowledge of rate analysis for different items of works.
3. Learn the different terminology of valuation and its techniques.
4. Study the departmental procedures of tender allocation and execution of work.
5. Introduce the basic concepts and principles of construction management and engage the students in real-world projects to acquire professional experience.
6. Summarize the various construction techniques including estimation, scheduling, resource management, and project financing.

COURSE OUTCOMES:

After a successful completion of the course, the student will be able to:

1. Analyse the different types of estimates, units of measurements in infrastructure projects.
2. Calculate the quantity of different items of work for different specifications as per SOR.
3. Assess the valuation of the property by various methods.
4. Prepare the tender document and explain different departmental procedures.
5. Apply the CPM and PERT technique to optimize construction project.

Mapping of CO with PO

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	1	0	0	0	0	0	0	0	1
CO2	3	3	3	2	0	0	0	0	0	0	0	1
CO3	2	3	0	0	0	0	0	0	0	0	0	1
CO4	2	2	2	0	0	0	0	2	0	0	0	1
CO5	3	3	3	3	0	0	0	0	0	0	3	3
Target	**2.6**	**2.8**	**1.6**	**1.2**	**0**	**0**	**0**	**0.4**	**0**	**0**	**0.6**	**1.4**

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS: -

Theory

SECTION –A

1. Estimating: Definition, Purpose, Type of Estimated, Data Required for Preparing Estimates, Items of Work, Description of an item of work, units of measurements of items of work, IS code of measurement of Building Works (IS1200).
2. Approximate Estimates: Definition, Purpose methods of approximate Estimating for Building and other (Civil Eng.Projects such as Irrigation, Water Supply, Highway Projects etc.)
3. Work out quantities Methods, abstracting Bill of Quantities, Provisional Items, Prime cost, Contingencies, Establishment Charges.
4. Specifications and Analysis of Rates, Prime Cost, Day work.
5. Valuation of Property: Value, Depreciation, Methods of Valuation, Rent Fixation and Present-Day cost

SECTION-B

Management of Works:

1.Tender: Tender Notice, Acceptance of Tender.
2. Contract Types, Contract documents.
3. Departmental methods of execution of work muster rolls, place work agreement, work order, stock, stores, tools and plants execution and supervision of jobs, use report sand cost control records.

SECTION-C

1. Systems of Approach, Optimization techniques, CPM and PERT, Scheduling and Financial, Material, Tool, and Plants Schedule Network, Compression and Updating, Application of Computer in Planning.

ASSESSMENT:

Continuous: Two Mid-Term tests and make up test if required.

Semester-end: Theory examination of 3 hours.

PRACTICALS:

COURSE OUTCOMES:

1. Calculate the quantity of different items of work for different specifications as per SOR.
2. Prepare the tender document and explain different departmental procedures.
3. Apply the CPM and PERT techniques to optimize construction projects.

CO PO Mapping of Practical CE31003													
CE31003 DESIGN OF RCC STRUCTURES	**CO**	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
	C01	3	0	0	0	0	0	0	0	2	2	0	2
	C02	3	0	0	0	0	0	0	0	2	2	0	2
	Target	**3**	**0**	**0**	0	0	0	0	0	**2**	**2**	0	**2**

List of experiments:

1. To draw plan of section of a public or a residential building.
2. To estimate quantity and cost of the building.
3. To analyse the rates of RCC components and brickwork.
4. To formulate tender and contract document of a public building.
5. To derive a project network for construction of building.
6. To estimate quantity and cost of road excavation.

ASSESSMENT:

Continuous: Evaluation of calculations & drawing sheets, internal submission and Viva Voce examination by internal examiner.

Semester-end: Practical Viva Voce Examination by external examiner.

Books Recommended:

Text Books:

1. Peurifoy R.L., Construction Planning and Equipment, McGraw-Hill Engineering, 7th Edition, 2010
2. Dutta B.N., Estimating and Costing, UBS Publishers & Distributors Ltd, 16th Edition, 2009.
3. Harpal Singh, Construction Management, Tata McGraw-Hill Publishing Company Limited, 14th Edition, 2010
4. Shrinath L.S., PERT and CPM, Affiliated East-West Press Private Limited, 4th Edition, 2010

Reference Books:

1. Chakraborti M, Estimating, Costing, Specification and Valuation in Civil Engineering, 12th Edition, 2012
2. B. C. Punmia, CPM & PERT, M Chakraborti, 5th Edition, 2010.
3. Vazirani Ratwani & Chandola S.P., Estimating, Costing, Specification and Valuation in Civil Engineering, Khanna Publication, New Delhi, 7th Edition, 2010

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. III year (4YDC)
CE: 21513: GEOTECHNICAL ENGINEERING – I

CREDITS:

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
						THEORY		PRACTICAL		TOTAL MARKS
T	P	Tu	T	P	Tu	CW	END SEM	SW	END SEM	
4	2	-	3	1	-	30	70	40	60	200

Pre-Requisite: Strength of Materials.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

1. **Describe and explain** the soil formation and soil structure.
2. **Classify** the soils and **identify** the soil engineering properties
3. **Solve** any practice problems related to soil stresses estimation, permeability, seepage including flow net diagram
4. **Evaluate** any practical problems related to consolidation like consolidation settlement, time rate of settlement
5. **Analyse** the stress distribution & shear failure by various methods.

Mapping of CO with PO

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	0	0	0	2	0	0	0	0	0
CO2	3	3	2	0	0	0	1	0	0	0	0	0
CO3	2	2	2	0	0	0	1	0	0	0	0	0
CO4	3	2	2	0	0	0	1	0	0	0	0	0
CO5	2	2	2	0	1	1	1	0	0	0	0	0
Target	2.20	2.2	2.0	0.00	0.20	0.20	1.20	0.00	0	0	0	0

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:
Theory:
Unit -1
Soil Mechanics: Definition and Scope, Factors of soil formation, Morphology, Pedological Classification. Introduction to Soil Structure and Clay Minerals, Structures of Kaolinite, Illite and Montmorillonite. Different Systems of Soil Classification i.e. Particle Size, Textural, Unified and AASHTO. Details of IS classification.

Unit –2
Soil Properties : Density, Void Ratio, Porosity, Moisture -Content, Grain Size Analysis, Dry Sieve Analysis, Wet Sieve Analysis and Sedimentation, Soil Consistency, Liquid Limit, Plastic Limit, Shrinkage Limit Explanation ofvarious indices like Flow-Index, Plasticity Index, Toughness Index, Liquidity Index, Activity Ratio etc.

Unit –3
Soil Water: Hygroscopic, Capillary and gravitational, Permeability of Soil, Darcy's Law, Laboratory determination of permeability and factors affecting permeability, seepage and flow net. Effective, neutral and total pressure, quick sand phenomenon

Unit –4

Compaction Characteristics of Soil, Moisture/Density Relationship, Factor affecting Compaction and Control. Compressibility and Consolidation of Soil, Terzaghi's one Dimensional Consolidation Theory, Pressure Void Ratio Relationship, Primary and Secondary Consolidation.

Unit –5
Boussineq's equation of stress distribution in soil due to concentrated load, line load, uniformly distributed circular area. Pressure bulbs and contact pressure, new mark's chart.

Assessment:
Continuous: Two midterm tests in a semester and a makeup test if required.
Semester-end: Theory examination of 3 Hours duration.

Course Outcomes (Practical):

Upon completion of this course, the students will be able to

CO1: Conduct laboratory tests to determine basic soil properties and classify soils based on standard procedures.

CO2: Perform field density tests and analyze soil compaction characteristics for geotechnical applications

Mapping of CO with PO

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	0	0	0	0	0	2	2	0	2
CO2	3	3	0	0	0	0	2	0	2	2	0	2
Target	3	3	0	0	0	0	1	0	2	2	0	2

PRACTICALS:

List of Experiments:

1. Determination of natural and hygroscopic moisture content of soil.
2. Determination of specific gravity of soil.
3. Determination of field density, field void ratio and degree of saturation of soil by core cutter apparatus.
4. Determination of field density, field void ratio and degree of saturation of soil by sand replacement method.
5. Grain size analysis of coarse grained soil using sieves.
6. Grain size analysis of fine grained soil by sedimentation using (i) pipette (ii) hydrometer.
7. Determination of liquid limit of soil by cassagrande's apparatus.
8. Determination of liquid limit of soil by cone penetrometer.
9. Determination of plastic limit of soil.
10. Determination of shrinkage factors of soil.
11. Determination of deferential free swell of soil.
12. Determination of coefficient of permeability of soil by-(a) constant head method, (b) variable head method.
13. Determination of compaction parameters by-(a) light compaction, (b) heavy compaction.
14. Determination of density index of sand.

Assessment: Conduction of various tests on Soil, internal submission and Viva Voice examination by internal examiner.

Semester-end: Practical Viva Voice Examination by external examiner

Books & References Recommended:

Text Books:

1. Punmia B.C., Soil Mechanics & Foundations, Firewall Media, 2017 (16th edition)

2. Alam Singh, Modern Geotechnical Engineering, CBS Publishers & Distributors, 2012 (3rd edition)
3. Gopal Ranjan & ASR Rao, Basic & Applied Soil Mechanics, New Age International, 2016 (3rd edition)
4. S.K Garg, Geotechnical Engineering, Khanna Publishers, 2016 (10+ edition)

Reference Books:

1. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publication Distributors.
2. V.N.S. Murthy, Soil Mechanics and Foundation Engineering, CBS Publishers & Distributors, 2010
3. Braja M. Das, Principles of Geotechnical Engineering, Cengage Learning, 7th Edition, 2010

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. III year (4YDC)

ENGINEERINGELECTIVE II
CE 31703: WATER AND WASTEWATER TREATMENT TECHNOLOGIES

CREDITS:

HOURS PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICALS		TOTAL MARKS
3	2	-	3	1	-	CW	END SEM	SW	END SEM	200
						30	70	40	60	

Pre-Requisite: ENVIRONMENTAL ENGINEERING

COURSE OBJECTIVES:

Course objective is to inculcate and aware about basic design considerations of various treatment options based on quality of raw water available of respective sources and also for municipal sewage treatment options. Also to design main units of proposed conventional watertreatment plant and conventional sewage treatment plant.

COURSE OUTCOME :

The students will be able to:

1. Explain impact of raw water quality on health and its mitigation, design of sedimentation tank, its types and factors affecting settling.
2. Analyze coagulants, factors affecting coagulation, jar test. design of Clariflocculator, Filtration unit, its types and multimedia filters.
3. Apply methods of disinfection, usage of free chlorine and combined chlorine, mechanism of chlorination with their advantage and disadvantage.
4. Design preliminary, primary and secondary treatment units of conventional sewage treatment plant.
5. Design biological treatment units viz. Activated sludge plant, SBR and methods of sludge treatment and disposal.

Mapping of CO with PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	1	0	2	2	1	1	0	0	1
CO2	3	2	3	1	0	0	1	0	0	0	0	0
CO3	3	1	3	1	0	0	2	0	0	0	0	0
CO4	3	2	2	1	0	1	2	0	0	0	0	1
C05	3	1	2	1	0	0	1	0	0	0	0	0
Target	3	1.6	2.6	1	0	0.6	1.6	0.2	0.2	0	0	0.4

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Unit – 1

Water Purification: Public attitude and national significance of water quality affecting use, quality control, history, inter-relationship of health, quality criteria for drinking water, necessity of treatment, water borne diseases. Theory, operation and design of settling tanks: Plain sedimentation, sedimentation basindesign, theory and practice, depth, detention period, over flow rate, flow velocity and capacities of basins, surface area, rectangular and circular settling basins, upward and horizontal flows, relations of length and width, inlet and outlet devices, baffles, sludge storages and sludge removal, tube settlers, theory and practices, sludge removal, sludge disposal, sludge blanket clarifiers.

Unit – 2

Coagulation: Theory of coagulation, common coagulants, other chemicals, polyelectrolytes, theory and practice, practical consideration in the use of coagulants with their merits, feeding devices, settling periods, measurement and observation of flocby jar test.

Sand Filtration: Theory of filtration, description of slow sand and rapid sand gravity filters, their comparison and merits, design of rapid and slow sand filters, media characteristics for filters, size and depth, filter gravel and under drains, negative head and other problems in filtration, rate controller, back washing of filters, amount of wash water, theory of multimedia and mixed media filter constituents advantages and disadvantages.

Unit – 3

Methods of disinfection : Purpose and methods, Chlorination, forms of chlorine, Chlorine Demand, Determination of Residual Chlorine, Doses required, effectiveness of Chlorination, Bacteria, Virus, Break Point Chlorination Theory, advantages and disadvantages, super chlorination and dechlorination, merits, prechlorination purpose and precautions, double chlorination, chlorine-ammonia treatment advantages and disadvantages, compounds formed with

chlorine in the presence of ammonia, effect of pH, effects of compounds in disinfection, other methods of disinfection in brief ozone, U.V., rays action of metals, Iodine, Bromine, Chlorine dioxides, Algaecides.

Unit – 4

Waste Water Treatment:

Introduction to waste water treatment and disposal: Introduction, necessity of treatment,extent of treatment, primary treatment works, screens, grit chambers, grease and oil removal, sedimentation, coagulation, flocculation.

Secondary treatment works, trickling filters, constitution, types, principles of working, design factors, humus tanks.

Unit – 5

Activated sludge plant, flow diagram, principles, final sedimentation tank, recirculation etc.

Anaerobic digestion of sewage sludge: Generation of Methane Design Principles of Digesters, Drying of Sludge and Ultimate Disposal, ultimate Disposal of Sewage on land and in Water.

Assessment:

Class work (30 marks) on the basis of regular evaluation of assignments, two Mid-Termtests and class attendance.

Semester end: Theory examination (70 marks) of 3 hours duration theory paper

PRACTICALS:

List of experiments:

1. To determine arsenic content by molybadate blue method in a given water sample.
2. To determine 'FLUORIDE' content in of a given water sample by using SPANDSmethod.
3. To study jar test & to determine the optimum dose of coagulant with the help of jartest apparatus.
4. To determine the sludge volume index (SVI) of a given sewage sample.
5. To determine kjeldhal nitrogen in a given water/wastewater sample.
6. To determine pH, moisture content, volatile & non- volatile substances in aSludge/Solid waste sample.
7. To study the characteristics of Bio-medical waste.
8. To study relevant IS Codes and national/international standards.

ASSESSMENT:

Sessional work (40 marks) - Evaluation on the basis of experiments performed & laboratory manual, internal submission along with attendance and Viva Voice examination by internal examiner.

Semester-end: Practical Viva Voice Examination (60 marks) by external examiner on the

basis of student's practical knowledge and viva-voce.

Books & References Recommended:

Text Books

1. Punmia,B.C., "Water Supply Engineering" Laxmi Publications(P) Ltd. New Delhi. 2016, 2nd edition.
2. Punmia,B.C., "Waste Water Engineering" Laxmi Publications(P) Ltd. New Delhi.2017. 1st edition.
3. Garg,S.K. "Water Supply Engineering" Khanna Publishers,Delhi.2017-2018,9th edition.
4. Garg,S.K. "Sewage Disposal and Air Pollution Engineering" Khanna Publishers,Delhi.2017-2018,9th edition.
5. Birdi G.S. & Birdie,J.S. " Water Supply and Sanitary Engineering" Dhanpat Rai Publishing Company(P) Ltd.,New Delhi.9th reprint.2016
6. Hammer,Mark J. & Hammer Mark J.,Jr. " Water and Wastewater Technology" PHI Learning Private Limited, New Delhi.2009.6th edition.

Reference Books

1. Manual on Water Supply & Treatment, CPHEEO, New Delhi. (1999), www.cpheeo.nic.in
2. Manual on Sewerage & Sewage Treatment, CPHEEO, New Delhi. (2013) www.cpheeo.nic.in
3. Peavy, Howard S.,Rowe, Donald R., Tchobanoglous,George., "Environmental Engineering" McGraw Hill Education (India) Pvt. Ltd. New Delhi, First Edition 2013.